FINAL REPORT OF THE MISSOURI DIOXIN TASK FORCE

submitted to
Governor Christopher S. Bond

OCTOBER 31, 1983

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Honorable Christopher S. Bond
Governor
State of Missouri
State Capitol
Jefferson City, MO 65101

Dear Governor Bond:

I hereby convey to you the final report of the Dioxin Task Force as requested in your executive orders 83-5 and 83-13.

In the eight months since its inception in February of this year, the Task Force has studied the volume of information on dioxin in the literature and as presented by experts in the field. The recommendations within this report reflect that study.

Please accept this report as adopted unanimously by the Dioxin Task Force.

Respectfully submitted,

James A. Finch, Jr.
Chairman
Governor's Dioxin Task Force

JAF:brd

Definition of Dioxin

This report deals with one extremely toxic member of a class of compounds commonly called "dioxins". Within the 75 possible chlorinated dioxins, there are 22 isomers of tetrachlorodibenzo-p-dioxin (TCDD). In Missouri, the contamination is almost exclusively with one highly toxic member of this family, the member "2,3,7,8-tetrachlorodibenzo-p-dioxin". For simplicity and unless otherwise stated, this report uses the terms "2,3,7,8-TCDD", "TCDD", and "dioxin" interchangeably, all referring to one member of a family of compounds.

TABLE OF CONTENTS

For a list of appendices, please see the additional volume entitled Appendices.

INTRODUCTION

On February 14, 1983, Governor Bond, by Executive Order, established the Governor's Task Force on Dioxin. It will be dissolved upon submission of this Final Report.

The Executive Order forming this Task Force included a charge to: "examine and evaluate all known methods, processes and technologies for the destruction and containment of dioxin, particularly as it exists as a contaminant in soil and sediment at various locations in Missouri;" and to "examine and evaluate the public health dangers associated with dioxin, particularly with respect to dioxin as it exists as a contaminant in soil and stream sediment at various locations in Missouri." The Task Force was then charged to "recommend a practical and effective plan of action for implementing comprehensive and permanent solutions to the public health and environmental problems caused by dioxin contamination in Missouri." The Executive Order mandated an interim report concerning the site at Times Beach as well as this final report.

In fulfilling the charges to examine public health and environmental problems and to examine and evaluate methods, processes and technologies the Task Force has examined extensive scientific literature and has heard testimony by a wide spectrum of experts from universities, governmental agencies, industries, and the public. It has heard over 50 hours of expert testimony and been provided with 10,000 pages of reports, scientific documents, and other related reading materials. In addition, in order to gain a better understanding of the Missouri problem, the Task Force made site visits to the St. Louis and Verona areas.

On June 1, 1983, the Task Force submitted its Interim Report to Governor Bond. It represented the preliminary opinions of the Task Force concerning immediate, yet temporary, remedial measures to be applied at Times Beach. In addition, the Report addressed the Minker and Stout sites because the Task Force believed there was sufficient urgency for interim actions at those sites. The report included important background materials and assessments of proposed dioxin destruction and remedial technologies.

This Final Report addresses the Governor's directions by giving an assessment of health effects based on currently available knowledge and by recommending remedial actions for all known sites, plus suggesting future research and study. In developing these recommendations careful consideration was given to the psychological and economic impact of the dioxin problem and proposed solutions on affected Missouri citizens.

The report includes additional background materials and acknowledgement of all experts who have been heard. These are attached as appendices. Transcripts of testimony heard and of proceedings of the Task Force meetings are available through the office of the Department of Natural Resources.

The Task Force wishes to thank the Directors of the Department of Natural Resources (DNR) and the Division of Health (DOH) and their staff members for their excellent cooperation in obtaining and providing literature, for arranging for witnesses whom the Task Force desired to hear, and for providing necessary staff work.

Based on our evaluation of all the testimony and data received, the Task Force recommends the following: (For explanation and amplification of these recommendations see the Section entitled Rationale for Recommendations).

RECOMMENDATIONS

I. The Task Force recommends that secure central storage of Missouri's soil contaminated with dioxin exceeding acceptable limits should be provided until proven technology is available to assure a comprehensive and permanent solution to dioxin contamination with minimum risk to public health and the environment.

II. The Task Force recommends that health studies on Missouri citizens potentially exposed to dioxin in residential, manufacturing or other occupational settings should be continued and expanded to assess the long-term public health effects due to dioxin.

III. The Task Force recommends that the Missouri Dioxin Strategy for secure storage of dioxin contaminated soils and for assessment of health effects, as stated in this report, be adopted and thereafter periodically updated. The Strategy includes the following components and provisions:

A. The Missouri Dioxin Strategy must include all sites regardless of CERCLA status.

B. High priority should be given to development and publication of an expedited schedule for sampling and analysis at all suspected sites, and for extensive grid sampling at known sites.

C. High priority should be given to the siting for and construction of a central storage facility and interim storage as required.

D. The central storage facility should be utilized only for dioxin contaminated solids.

E. A primary aim should be the reconstruction and reinhabitation of all sites.

F. The state should establish criteria and follow a uniform policy regarding residents and owners of dioxin sites.

G. The experience gained at Seveso, Italy, should be utilized to the extent possible.

H. The residual level of dioxin allowed to remain after excavation and decontamination must be specified.

I. The State should begin immediately to communicate the criteria for safe transportation of dioxin contaminated soils on Missouri roads and highways to address public concern.

J. A Missouri Program in Toxicology should be established.

K. An advisory panel, similar in composition to this Task Force, but including two dioxin site resident representatives, should be formed to advise the Director of DNR.

HEALTH RISKS

In order to responsibly assess the possible remedial actions, it is necessary to understand the public health dangers associated with dioxin. For purposes of this report, the health effects of dioxin are classified as acute, chronic and carcinogenic. There is some overlapping of these areas which means that the symptom-complex interrelationships also must be examined. The following is a brief summary of each of these areas:

1. Acute Toxicity. The acute toxicity of relatively large doses of dioxin incident to industrial accidents is well documented. Chloracne appears within several weeks and may persist for many years. It is disfiguring and may produce psychological stress. Liver disease may also be found but is not consistently evident in man. Porphyria cutanea tarda is another condition which may be produced by exposure.

Cell mediated immunity is decreased by dioxin in mice. There is minimal evidence on whether dioxin exposure causes immunosuppression in humans. In a study of 45 children from zone A, the area of highest dioxin concentration, of Seveso, Italy, Pocchiari, et. al. showed in four repeated examinations over the first year following the accident that there were no immunological differences between the exposed children (21 of which had chloracne) and a minimally exposed comparison population.

Dioxin is a potent inducer of aryl hydrocarbon hydroxylase (AHH) and at least a dozen other enzymes in animals.

2. Chronic Effects. The most obvious chronic effect is persistent chloracne. Other effects such as porphyria cutanea tarda, liver dysfunction, and functional changes in kidneys, pancreas, blood and lipid metabolism, have been reported following accidental exposure to dioxin and related compounds but it is difficult to determine whether the signs and symptoms observed were due to dioxin or other chemicals involved.

Neuropathologic findings including nerve conduction defects and demyelinization of nerves, particularly in the lower limbs, have been demonstrated. Numerous neuropsychiatric symptoms such as fatigue, depression and headache have been described, but cause and effect relationships with dioxin are difficult to validate with present methods.

Reproductive effects of dioxin such as fetotoxicity and teratogenesis have been shown in a number of animal species. However, human epidemiologic studies in Germany, the United States, Australia, and at Seveso have shown no apparent derangements of gestation, no fetal loss, no gross malformations and no cytogenetic abnormalities. A study in Oregon alleging an increase in abortions among exposed women was subsequently declared valueless by reviewers from Oregon State University and from Australia, New Zealand and the United States government. A North Vietnamese study alleging increases in birth defects in the children of exposed Vietnamese soldiers cannot be evaluated because the study itself is not available.

3. Carcinogenesis. Probably the most important and yet the least understood possible effect of dioxin is carcinogenicity. It is generally agreed that dioxin is an inducer of cancer in rats and mice. Therefore, it has a potential for causing cancer in humans. It is unnecessary, for the purposes of this report, to decide whether dioxin might be a cancer initiator, a cancer promoter, or whether its action is exerted through enzyme or cellular immunity changes.

Two methodological problems in the assessment of the possible carcinogenic action of dioxin are the long "latent period" of most cancers and the small numbers of exposed individuals from industrial accidents that occurred more than twenty years ago.

Studies in Sweden and testimony before the U.S. Congress by the Director of the NIOSH Division of Surveillance, Hazard Evaluations, and Field Studies have indicated a higher risk of soft tissue sarcomas among those workers exposed to dioxin and the phenoxy acids. The question of an increase in cancer rates among Vietnamese is not fully resolved. A study of participants in "Operation Ranch Hand" of the Air Force has not implicated dioxin in carcinogenesis nor have the studies in Finland and New Zealand. Definitive results from the Air Force study cannot be expected until a sufficient period of time has passed to rule out or implicate dioxin as a carcinogen among those exposed to "Agent Orange".

An EPA panel of experts in July 1983 prepared a draft report after considering all available evidence which stated dioxin must be considered a probable human carcinogen.

4. Dioxin Symptom-Complex Interrelationships. It is customary, from the clinical point of view, to describe a number of symptoms related to an infection or an environmental exposure as a symptom-complex with various stages of the disease. In the case of dioxin exposure there are those who would insist that chloracne is the "stage one" or hallmark of all subsequent chronic or carcinogenic effects and that without chloracne, no subsequent effects would be expected. However, considering the various routes of exposure, the degree of exposure, and the shortness of the time since such exposures occurred, it is impossible to state unequivocally that chloracne is a prerequisite for dioxin intoxication.

There is some published evidence that soft tissue sarcomas may occur in persons exposed to dioxin who had no preceding chloracne. The question of other adverse health effects such as nerve conduction defects and reproductive problems occurring without prior chloracne is not resolved. However, there is certainly enough concern about this issue to warrant continued investigation. An interrelated problem requiring further research is the reported background adipose tissue levels of dioxin among the "normal" population which varies from 0.007 to 0.020 ppb. These background levels have been established in studies by the U. S. Air Force, Veterans Administration, and Canadian government. Therefore, it is possible that there are other sources of dioxin in the environment. Such sources may include incineration and chemical derivatives of the trichlorophenol synthesis such as hexachlorophene and 2,4,5-T. The possible sources are not yet well defined.

MISSOURI HUMAN HEALTH RISK ASSESSMENT

The problem of dioxin in Missouri is that the potential for exposure of the affected population consists of protracted contact with soils contaminated by spraying with a mixture of oil and dioxin more than ten years ago. The only evidence presented to the Task Force of any acute human effects occurred at a horse arena where the level of dioxin was measured at 32,000 ppb - a level much higher than that measured at any of the residential sites. The fact that horses, pets, and birds died immediately following the road and horse arena spraying may be due either to species differences in sensitivity to dioxin in these animals, or to a high dosage and close contact with the sprayed material, the soil and the dust, or to other unknown contaminants in the sprayed material.

For most Missourians the likely exposure has been limited to dioxin in the soil, the dust emanating from the soil, and the erosion and mobilization of the soil as sediment in surface waters and the resulting contaminated fish. There is tight binding of dioxin to soil particles and it has low solubility and vapor pressure which reduces its solubilization and percolation into ground waters or vaporization into the atmosphere. Therefore, the risk assessment in Missouri is confined largely to the possible chronic and carcinogenic effect of low dosage exposure to dioxin in soil over a period of many years.

Bioaccumulation of dioxin in fish from contaminated streams has been shown in Missouri. It is believed that there is limited uptake into food plants. Therefore, the human food chain may be affected.

It must be cautioned that a complete assessment of the health risk at this time is not possible for the following reasons:

1. Recent health studies undertaken by the Missouri Division of Health and NIOSH are not complete. These reports, when submitted, must be carefully examined.

2. Further study is needed concerning the rate of absorption of dioxin from contaminated soils. Bioavailability of dioxin may be limited by soil binding which appears to increase over time.

3. The soil sampling procedures used by EPA to date have primarily been designed to detect contaminated areas and not to evaluate habitant exposure.

4. Much of the available information of health effects has come from exposure at industrial accidents where the level of the actual exposure was largely unknown and the route of exposure was quite different from soil contact.

5. The knowledge of background levels of dioxins in humans is inadequate at present.

6. The actual past dioxin exposure histories of Missouri residents are only gross estimates. Exact determination of an individual's exposure to dioxin is extremely complex and currently can only be estimated. In the future

it is expected that tests to measure tissue and blood levels of dioxin will be available and make human risk assessment more precise and simpler. For the present, using worst case assumptions, experts from the Centers for Disease Control have decided that a concentration of 1 part per billion in composite soil samples should be considered the upper limit of safe exposure in residential settings. It is important to note that children would have the most exposure to soil and dirt by ingestion and would probably receive the greatest dose per body weight. In adults with less soil contact the risk could be significantly less. Continuous and extended exposure to this soil level would be expected to increase a person's risk of cancer by one in one million in six to seven years. A review of this standard is being conducted by the Centers for Disease Control. A tentatively proposed maximum dioxin level in water is at the parts per quintillion (10 raised to the minus eighteenth power) level, based on the biologic concentrating capacity of aquatic organisms which may be found in the human food chain. It should be added that such levels cannot yet be analytically determined.

For the present, therefore, we have no choice but to use the limit of 1 ppb of dioxin in residential soils as the upper limit of allowable soil concentration, with the resulting stream sediment, water contamination and food chain content being some smaller concentration.

HEALTH CONCLUSIONS

The Task Force reaches the following conclusions on the health effects of dioxin exposure:

1. Dioxin is acutely and chronically toxic to humans as demonstrated in accidental large, but unknown dosage exposures.

2. Dioxin may be absorbed in the human by skin contact, by inhalation, and by ingestion.

3. In Missouri, the potential dosage exposure is complicated by the tight soil binding proclivity of the compound, the long-term (more than 10 years) exposure to soil levels ranging from one to more than one thousand parts per billion, and the variations in exposure to the contaminated soils due to differences in age, occupation, and living environment.

4. The review group convened in July 1983 by EPA and the Director of the Division of Surveillance, Hazard Evaluation, and Field Studies of NIOSH of the USPHS have characterized dioxin as a probable carcinogen.

5. Present risk assessment procedures based upon the reproductive and carcinogenic effects appear to suggest a maximum safe level of 1 ppb in residential soils of Missouri. Levels in water and human food chain vegetation, mammals and fish may be required. CDC and EPA are encouraged to establish standards for allowable levels of dioxin as soon as possible.

6. Little is presently known about: adipose tissue levels of dioxin in "normal" or unexposed individuals in comparison to those with known exposure; the absorption and metabolism of dioxin and related compounds; the long-term effects of various dosages; entry into the human; and the biological availability of the compound in the various soil, water and air conditions in which dioxin is now being found.

7. Human contact and exposure to contaminated soil should be minimized.

8. Sufficient funding should be provided for appropriate follow-up studies to be conducted on the exposed populations.

9. Careful consideration should be given to dealing with the emotional stress of living in and near contaminated areas. Effective methods should be developed to consistently advise and counsel residents of contaminated areas.

10. There should be continuation of health education for the general public about dioxin. There should be continual review of all research concerning dioxin. Uncertainty about the health effects of exposure to dioxin has caused fear and psychological and emotional stress. Health education techniques, including the dioxin hotline, are essential to the well being and rational activity of our citizens.

11. There is no human health benefit attributable to dioxin which is usually produced as an unwanted by-product in chemical manufacturing processes.

A primary concern of the Task Force was the determination whether the dioxin contamination of the soils of various Missouri communities since 1970-71 required only continued surveillance of the health of the individuals exposed or whether the past decade of such soil-dioxin exposure had been, and continues to represent, a sufficient health and environmental hazard to require remedial action. Weighing the testimony given, and other information made available to us, it is the conclusion of the Task Force that the dioxin contaminated soil in Missouri does constitute a hazard to the health of citizens exposed to such contaminated soil. The degree of the hazard is not presently determinable; therefore, deliberate, prudent remedial action should be taken to eliminate future exposure and health studies should be continued and expanded.

RATIONALE FOR RECOMMENDATIONS

I. The Task Force recommends that secure central storage of Missouri's soil contaminated with dioxin exceeding acceptable limits should be provided until proven technology is available to assure a comprehensive and permanent solution to dioxin contamination with minimum risk to public health and the environment.

After considering all of the scientific literature and testimony provided, the Task Force concludes that a permanent solution to the dioxin contamination in Missouri cannot be recommended at this time because there is no proven technology for the safe destruction of dioxin in soils. Secure storage should be provided until destruction technology becomes available.

Secure storage will require about five years to accomplish. Based on the Seveso experience with excavation and storage, costs could be about $70.00 per cubic yard. However, after considering all available information on remedial technologies, health effects, and impact on Missouri and its citizens, the Task Force believes that this action must now be taken.

In the Task Force's interim report it was concluded that no proven technology then existed for the destruction of dioxin. (See Chapter 6 of that report for an assessment of available technologies.) The Task Force now concludes that adequately proven technologies for the destruction of dioxin in soils will not be available for several years.

Incineration is probably the nearest to being a proven technology, but it appears that perhaps five years of laboratory and EPA permitted pilot studies would be required before construction of an incinerator could begin. Also, it is not clear that an exemption could be obtained from the EPA requirement that residues from destruction of acutely hazardous wastes must be stored in a facility meeting the same requirements as the material before destruction. Since the incineration of soil would not drastically change its volume, a storage facility, as recommended above, might still be required. Incineration, then, is not a short term option, and all other technologies appear less likely to be applicable within the next decade.

The Task Force also concludes that technologies which require extensive processing, such as solvent extraction, are inappropriate at this time. These approaches create more waste than originally existed, are inherently expensive, and present considerable risk of environmental release and human exposure.

II. The Task Force recommends that health studies on Missouri citizens potentially exposed to dioxin in residential, manufacturing, or other occupational settings should be continued and expanded to assess the long-term public health effects due to dioxin.

The Task Force recommends that health studies should be expanded to include all identifiable Missouri citizens who potentially have been directly exposed to dioxin contaminated materials. In addition, Missouri should participate in studies similar to those recently reported on the dioxin content of human adipose tissue to assist in determining background levels due to other exposures.

III. The Task Force recommends that the Missouri Dioxin Strategy for secure storage of dioxin contaminated soils and for assessment of health effects, as stated in this report, be adopted, and thereafter periodically updated.

The widespread distribution of dioxin in Missouri is an unfortunate reality which has presented serious health concerns and a serious social and economic problem to the State and to many Missouri citizens. Lacking a technology for destruction of dioxin contaminated soil, a definite end to potential exposure of citizens and the environment should be provided by secure storage which would permit return of the affected areas to productive use.

Of particular concern to the Task Force is the public perception of inactivity followed by abrupt actions. Therefore, it is recommended that this strategy for secure central storage, as herein outlined and recommended, should be adopted by the DNR, DOH and the EPA immediately. To the extent possible, the State should assume leadership in the implementation of this strategy, even if some additional costs are incurred by the State. The public must know that a single coordinated strategy is being followed to achieve an attainable resolution to contamination in Missouri, and that sufficient funds are available to implement it. To address the concerns of Missouri citizens, implementation of this strategy should include an opportunity for public comment and public hearings. Once adopted, this strategy should be periodically updated to keep Missouri citizens informed and to permit their comment on actions to be taken.

The Task Force believes that specific responsibility should be assigned the Director of DNR to assure that priority is maintained on this problem until closure of the secure storage facility. A system for information release should also be established so Missouri speaks with one voice to residents and owners of dioxin sites and to the public. Such information release might be accomplished by an expanded Dioxin Update and periodic press releases. Regular listing of the implementation status at each site should be included. To the extent possible, information from State agencies should be supplemented with sufficient explanation to permit the public to view the information in the context of this Strategy. Information released or published by EPA, Centers for Disease Control (CDC), Veterans Administration (VA), National Institute for Occupational Safety and Health (NIOSH), or others should be summarized, evaluated, and commented upon to help the public to assess its impact on the Missouri Dioxin Strategy.

It is the opinion of the Task Force that the State of Missouri has a public image as the dioxin center of the USA. That problem should be addressed and solved, even if the solution requires the expenditure of some funds currently not available. Otherwise, that image will continue to disrupt the lives of its citizens and plague the economic well being of the State. A decisive plan and responsible action will clearly demonstrate to the public that Missouri is willing to make and execute the necessary decisions to ensure the health and well-being of her citizens and to provide a good environment in which to live. It is believed that this was the experience of the Seveso Authority, whose representatives presented to the Task Force a description of their response. Some of their decisions may prove to be inadequate or excessive, but the Seveso Authority took action according to a publicly stated plan and subsequently reinhabited the area, permitting life to go on until an ultimate answer can be found.

The extremely toxic properties and potential health effects of dioxin have caused an enormous effort to be mounted to rid the environment of this hazardous substance. While this high level of concern is certainly justifiable, dioxin also has several properties which greatly reduce exposure to humans and migration in the environment. These properties include its extremely low solubility in water, extremely low volatility, and tight binding to soils. While dioxin is extremely toxic, dioxin as it exists in Missouri soil may not be as serious a problem as other contamination by very toxic and carcinogenic hazardous wastes. Our zeal to rid the State of dioxin should not deplete financial and human resources to the exclusion of the other very important hazardous waste problems in Missouri.

In summary, the Task Force concludes that an orderly, planned removal of dioxin contaminated soil to a secure storage facility best serves the interests of Missouri and its citizens. Recognizing the potential effects of dioxin, it seems prudent to take decisive, but not panic-driven actions to eliminate potential exposure and control the spread of dioxin in Missouri. A planned approach will require several years to implement and will require delay at some sites relative to others. Some sites will require short term remedial actions due to relative risks of exposure or probable spread of contamination. Most other sites should be left intact until removal and storage can be accomplished. For a few sites it seems possible that the health and environmental risks may be eliminated without excavation. These sites might be left intact with only long term surveillance and maintenance.

A. The Missouri Dioxin Strategy must include all sites regardless of CERCLA status.

The majority of the confirmed sites in Missouri contain contaminated soil which can be treated in a similar manner. In the Task Force's opinion, these sites should be handled as one problem under the Comprehensive Emergency Response, Compensation, and Liability Act (CERCLA). If this is not possible under Federal law, Missouri should nevertheless follow a comprehensive strategy for all sites.

Under the present CERCLA Law all hazardous waste sites undergo a site evaluation and ranking procedure. Based on a large number of parameters, each site is assigned an overall priority number which determines if that site qualifies for remedial monies under CERCLA. Currently only 6 of 33 dioxin sites in Missouri qualify for these funds, which are being administered on a site by site basis.

To remedy this situation, the State has requested that EPA combine the 33 sites for consideration as a single CERCLA site and currently is conducting negotiations with EPA to that end. The Missouri dioxin problem is unique in that while the sites are not contiguous, they are linked together because of the same type of contamination, namely dioxin in soil, the common origin of much of the material, and uniformity of the method of disposal. Individual listing of the sites causes extreme duplication of effort within a number of state agencies in every facet of handling of the sites, including health studies, remedial actions, and attempts at cost recovery. Feasibility studies

being done for EPA on several of the CERCLA sites are identifying the same range of solutions. Considering each of the sites separately adversely affects the type of solution selected and the cost of that solution. Since in Missouri the total cost of transporting materials off-site appears to be a small fraction of the total cost of remedial actions, a policy of treating all non-contiguous sites separately is not cost effective or logical. Therefore, it is recommended that the State continue to make every effort to have the 33 sites ranked as a single CERCLA site.

Should this primary course of action not be possible, the state of Missouri should still follow a uniform strategy to fully address the dioxin problem. The residents of non-CERCLA sites are no less concerned with the potential health problems, loss of property use, land values, and the overall psychological effects of the problem than those on sites which have higher CERCLA risk assessment point totals. If federal law cannot address their plight, the state of Missouri must provide the necessary uniformity of action.

B. High priority should be given to development and publication of an expedited schedule for sampling and analysis at all suspected sites, and for extensive grid sampling at known sites.

It is recommended that adequate sampling and analytical capabilities should be established or contracted by the State to provide this critically needed information as soon as possible.

An expedited timetable for comprehensive sampling of all sites, and prompt analysis of samples taken, should be developed to define the total problem in Missouri. It is recommended that the State should supplement its own resources with contract sampling and analyses to provide timely response. It is also recommended that a careful study by industrial hygiene experts should be made to determine the protective equipment appropriate to the sampling activity. Workers should be protected from expected danger, but residents should not be unnecessarily alarmed by overemphasis on worker protection.

C. High priority should be given to the siting for and construction of a central storage facility and interim storage as required.

A timetable for selection and construction of the facility and estimates of the period of time required to accomplish secure storage should be given at the earliest possible date.

The Task Force recommends that several potential storage sites should be selected and critically evaluated immediately. The criteria for the facility should include complete encapsulation of the dioxin contaminated soils and solid debris; collection, monitoring and treatment of water from the facility prior to release to the environment; prevention of rupture of the facility due to thermal expansion and contraction or moderate earthquake activity; and separation from the existing soil and ground water system. Criteria for the site should include State ownership; low land usage but with parks and wilderness areas excluded from consideration; accessibility for soil transportation; minimal risk of public exposure; and utility of the site following facility closure.

The Task Force specifically recommends that Times Beach should be included in the evaluation of potential sites. In spite of obvious concerns about flooding, Times Beach has several advantages as a location for a well constructed facility. It is estimated that about ninety percent of Missouri's dioxin contaminated soil is located in eastern Missouri with about sixty percent being in the Times Beach roadways. Potential for exposure and for spread to the environment and total cost could all be minimized by locating the storage facility on this site.

If about sixty acres of Times Beach were filled with clean soil to above maximum flood level, an above ground facility, similar to those built at Seveso, could be constructed to safely collect and control water from the facility. The construction of a levee, which may be required to permit excavation and removal of soil to another site, would provide additional protection for the facility. Following closure and replanting, the area should be made available for public use.

D. The central storage facility should be utilized only for dioxin contaminated solids.

It is recommended that alternate technologies, such as incineration, should be utilized for the small amounts of existing liquid wastes containing dioxin. The central storage facility must be constructed exclusively for the containment and control of dioxin contaminated soils and associated solid debris. The Task Force concludes that existing or proposed hazardous waste landfills are not acceptable alternatives.

The high probability that ultimate destruction of dioxin contaminated wastes may be required and become feasible in the future dictates that only solid dioxin wastes should be included in this facility. Non-contaminated solids, such as houses, trailers and trees, should not be stored in the dioxin facility simply because they are located on a dioxin site.

E. A primary aim should be the reconstruction and reinhabitation of all sites.

Decisions should be made for each site based on total assessment of risks of the spread of dioxin in the environment and risks to the health of residents and the public. Special efforts should be made to maintain the integrity of affected communities, and minimize the financial burden.

The Task Force recommends that the preservation of neighborhoods and communities should remain a high priority. The Missouri Dioxin Strategy must recognize that disruption of residents' lives has already occurred, with accompanying emotional stress, and that actions taken should be sensitive to residents' concerns. Property purchases do not solve the problem.

F. The state should establish criteria and follow a uniform policy regarding residents and owners of dioxin sites.

Included should be criteria for temporary relocation to reduce exposure, temporary relocation during excavation and reconstruction, level of

reconstruction, replacement of personal property, title clearance on reconstructed sites, and maintenance and control of sites stabilized and left intact.

To build and maintain public confidence in the Missouri Dioxin Strategy, a uniform policy must be communicated and followed. While it is recognized that different actions will be required at different sites, and that all residents' concerns and expectations cannot be universally satisfied, actions that are taken must be administered fairly and equitably. In particular, during relocation of residents, adequate consideration must be given to protecting family structure and minimizing psychological and economic impact.

G. The experience gained at Seveso, Italy, should be utilized to the extent possible.

Much information is available on worker protection, sampling techniques and construction engineering data. This should be utilized to minimize response time and costs in Missouri.

The Task Force was impressed by the efforts of the Lombardi Government and its agent, the Seveso Authority, in addressing the problem at Seveso. A great deal of information was generated and should be utilized by the State to the extent possible. One of the problems they encountered was the delay in obtaining analyses during excavation. It is recommended that the State should address that problem before beginning excavation since it strongly affects both the timeliness and cost of excavation.

The Task Force recommends that a summary of the Italian health studies should be provided to Missouri citizens, along with their findings on dust monitoring and other aspects of excavation and storage.

H. The residual level of dioxin allowed to remain after excavation and decontamination must be specified.

The Task Force recommends that CDC develop residual levels of clean up which will permit return of residential and agricultural properties to unrestricted land use as soon as possible. In addition, certain other residual levels, which may be site specific, should be developed for restricted use in areas such as commercial and industrial settings. Excavation and processing of contaminated soil must take into account the health and safety of workers and the local population.

The Task Force concludes that properties should be returned to unrestricted use, and removed from the dioxin registry, at the earliest possible date. To accomplish this, acceptable residual levels for clean up must be established.

I. The State should begin immediately to communicate the criteria for safe transportation of dioxin contaminated soils on Missouri roads and highways to address public concerns.

A mechanism must be developed for educating and reassuring residents and the public near any proposed route over which transportation of dioxin contaminated soil will occur. The concerns of these citizens are no less important than those of residents, workers, etc. The Task Force believes that state-of-the-art technology can provide all of the needed protection and that a format must be found for conveying this information.

J. A Missouri Program in Toxicology should be established.

It must be recognized that dioxin is by no means the last toxic material which may threaten the health and well being of Missouri citizens. To assist in final decisions regarding dioxin destruction and to provide a system for informed and rational future responses to toxic substances, a State Program in Toxicology should be established. That program should include an efficient system for gathering information, state-of-the-art analytical development capabilities, and appropriate animal toxicological research facilities.

The Task Force recognizes that a program in toxicology cannot be implemented to provide immediate response to the present dioxin problem. However, once secure storage of dioxin contaminated soils is provided, many dioxin questions will still need to be addressed as the ultimate destruction of dioxin is considered. This program will assist in the continuing evaluation of dioxin and will provide for an early response to future toxic waste issues. The Task Force strongly recommends that such a program should be established as a State facility, utilizing, to the extent possible, the capabilities that already exist in the universities and industries in Missouri through cooperative programs. The recently enacted hazardous waste legislation will have limited success until it is possible to define and quantitate compounds and define their degree of hazard to human health through toxicological testing and research.

K. An advisory panel, similar in composition to this Task Force, but including two dioxin site resident representatives, should be formed to advise the Director of DNR.

This panel should exist only until secure storage site closure is accomplished. It should make recommendations concerning final remedial actions and long term health studies. The Task Force believes that such an advisory panel with citizen representatives from academia, public groups, industry and dioxin site residents could provide valuable public input and oversight of the implementation of the Missouri Dioxin Strategy.

SITE SPECIFIC RECOMMENDATIONS AND PRIORITIES

Recommendations on remedial actions to be taken at each site and the relative site priorities are based on the information presently available, and should be altered as new facts, particularly from more intensive sampling, become available. Recommendations are based on the assumption that the Missouri Dioxin Strategy for secure storage will be adopted and that necessary funding will be provided to implement the plan under CERCLA or by the State.

In developing recommendations and priorities, the following factors were given primary consideration by the Task Force: overall risk to residents, workers and the environment; exposure risks to residents (especially children) and workers; potential for erosion and dusting; maintenance of neighborhoods and property values; and long term effects on Missouri and its citizens.

Due to the similarity of circumstances at some sites, and the widely varying circumstances at others, the Task Force chose to assign priorities and make recommendations based on groups of similar sites. (Any future confirmed sites must be separately evaluated and acted upon.)

Our recommendations are as follows:

Group I: Sites where short term excavation and interim storage of excavated soils should be considered to prevent exposure and restore the neighborhood.

- Sontag Road
- Quail Run

It is recommended that extensive sampling, temporary relocation of residents, excavation of soil with removal to an off-site interim storage facility, reconstruction and reinhabitation should be planned and implemented as soon as possible.

Group II: Sites where short term stabilization actions to prevent exposure or erosion should be taken, with the site remaining intact until secure storage can be accomplished.

- Minker
- Stout
- Saddle and Spur Club
- Cashell Residence
- Ruth Sullins Property
- Romaine Creek

It is recommended that short term actions should be taken to determine the potential for exposure and erosion, then provide temporary protection, possibly including off-site storage, until permanent removal, secure storage, reconstruction and inhabitation can be accomplished. (See recommendations on Minker-Stout in the Interim Report of the Task Force.)

Group III: Sites which should remain intact until secure storage can be accomplished.

Spring River
Denney Farm
Shenandoah Stables
Bliss Farm Road
Wall Property and Piazza Road
Bubbling Spring Arena
Timberline Stables
Erwin Farm
Rusha Farm
Times Beach
Methodist Church
Bliss Oil Frontenac
Mid-America Arena
Sand Cut Road
Baxter Gardens

It is recommended that these sites should be continuously assessed as new sampling information becomes available.

Group IV: Sites which should be assessed for potential exposure, dusting, erosion and the presence of utilities in affected areas. Depending on that assessment, the areas should be paved and excavation and use controlled, or they should be included in Group III for excavation and secure storage.

Southern Cross Lumber Company
Hamill Transfer Company
Overnite Transfer, Inc.
Jones Truck Lines

Group V: Sites where other remedial actions are in progress or being negotiated.

Syntex Verona
Syntex Springfield
Neosho Digester, Trench, Tank, Spill Area and Wastewater School
Bill Ray Farm

It is recommended that the current negotiations and remedial actions should continue with the State providing secure storage, as required, to expedite resolution.

Group VI: Sites where sufficient data is not available for recommendation.

Bull Moose Tube Company
Community Christian Church

RECOMMENDATIONS FOR FURTHER RESEARCH

The Task Force recommends that the following scientific studies should be done to expand the available data base on dioxin with emphasis on ultimate disposal solutions:

1. Physical properties of dioxin in water and other solvents should be determined.

2. The binding mechanism of dioxin to a variety of soils, and the soil water distribution coefficients should be determined.

3. The method(s) by which dioxin moves in the environment should be determined and quantified.

4. The natural decay rate of dioxin in water and a variety of soils should be determined.

5. The temperature-vapor pressure relationship for soil bound dioxin should be quantified, and the ambient rate of volatilization from soil determined.

6. Parameters for the volatilization of dioxin bound to soil and for incineration of volatilized dioxin should be determined.

7. The ash from incineration of dioxin bound to soil should be analyzed to determine if the resulting ash can be delisted under RCRA.

8. Continuing work should be done on insitu treatment of dioxin contaminated soils (e.g. chemical destruction).

9. Microbial degradation studies to find or develop an organism which can safely and economically degrade dioxin under field conditions should be continued.

10. Acute and long term health studies in multiple species to clarify the:

    a. Absorption of dioxin from soils and other media and from the food chain.

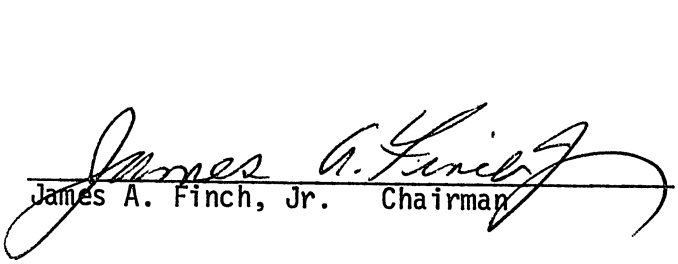
    b. The metabolism of dioxin.

    c. The toxicology and carcinogenic potential of a prolonged period of low dosage of dioxin.

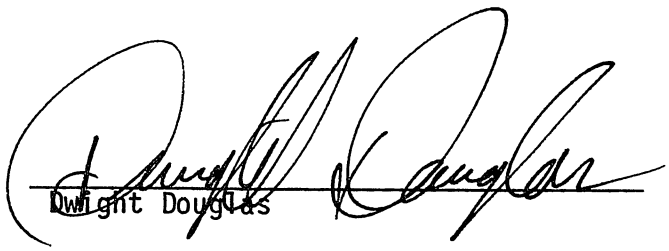
11. The determination of tissue levels of dioxin to include: the normal or "base line" levels of dioxin in the tissue of "unexposed" humans; the possible low dosage cumulative tissue concentrations over time; the change in such tissue levels over time in highly exposed individuals; and the correlation of blood and tissue levels of dioxin with different types of exposure.

12. Continuation and expansion of the current epidemiologic and clinical studies of the individuals exposed to dioxin in industrial accidents; exposed through protracted soil contact such as in Missouri; and in groups otherwise exposed in the past and at present to other chemical product derivatives of trichlorophenol, possibly contaminated with dioxin.

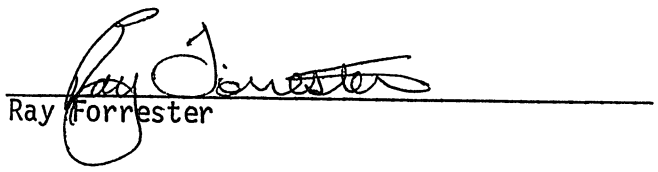
We, as members of the Governor's Dioxin Task Force, do hereby approve the Task Force report this 31st day of October, 1983.



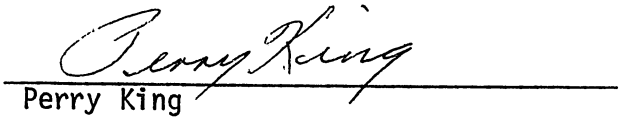
James A. Finch, Jr. Chairman



Dwight Douglas



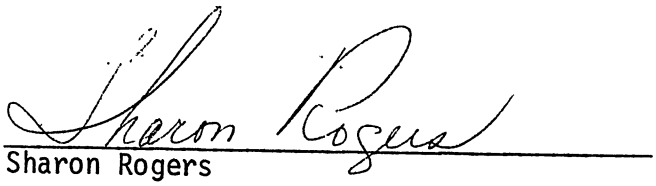
Ray Forrester



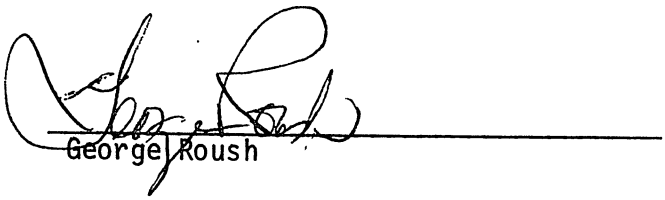
Perry King

Robert L. Powell

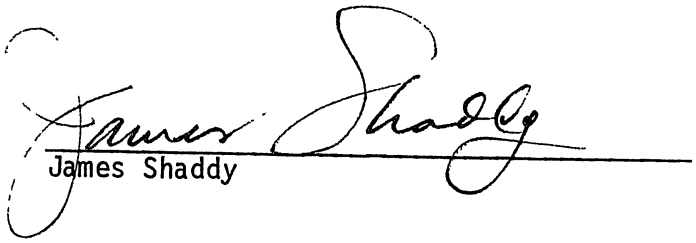
Carl J. Marienfeld



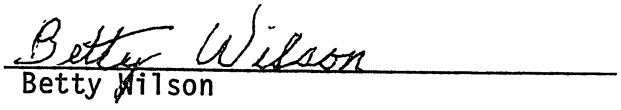
Sharon Rogers



George Roush



James Shaddy



Betty Wilson

GLOSSARY OF MEDICAL TERMS

Acute: Having a short or relatively severe course.

Adipose tissue: Fatty tissue.

Aryl hydrocarbon hydroxylase (AHH): A normally occurring liver enzyme, the function of which includes the metabolism or break-down of both natural and poisonous substances in the body. In certain laboratory animals, this enzyme has changed some substances into carcinogens.

Carcinogenic: Producing cancer.

Cell mediated immunity: Specific acquired immunity in which the role of small white blood cells called T-lymphocytes is predominant; it includes certain aspects of resistance to bacterial and viral infections, to cancer, and to organ transplants, and has a role in certain allergies.

Chloracne: Skin eruptions that are somewhat similar to but sometimes more severe than teenage acne, but unlike teenage acne are due to exposure to organic compounds containing chlorine or other related chemicals.

Chronic: Persisting over a long period of time.

Cytogenesis: The formation and development of cells.

Demyelinization: To remove the myelin which covers some nerve fibers. The myelin is a white fatty substance which forms a sheath around certain nerves.

Fetotoxicity: The quality of being poisonous to the fetus.

Immunosuppression: Diminution of the immune response.

Lipid: Any one of a group of complex compounds which include fats, oils, fatty acids, waxes, etc.

Neuropathologic: Pertaining to diseases of the nervous system.

Neuropsychiatric: Pertaining to diseases that may have both a neurologic and psychiatric basis.

Porphyria cutanea tarda: A disease in which the metabolism of porphyrins (a chemical produced in the liver) is disturbed resulting in chronic skin lesions and an enlarged liver.

Soft-tissue sarcomas: A type of cancer found in muscle, fat, nerve, or connective tissue.

Synthesis: The formation of a complex chemical compound by the combining of two or more simple compounds.

Teratogenesis: The production of physical defects in the developing fetus in utero.

EXECUTIVE ORDER
83-5

WHEREAS, extensive laboratory testing has confirmed the presence of dioxin at several locations in Missouri; and,

WHEREAS, dioxin is a potentially deadly chemical which threatens the health and safety of thousands of Missourians,

NOW, THEREFORE, I, CHRISTOPHER S. BOND, GOVERNOR OF THE STATE OF MISSOURI, by virtue of the authority vested in me by the Constitution and laws of Missouri, hereby establish the Governor's Task Force on Dioxin (hereinafter the "Task Force") which shall be composed of such residents of Missouri as from time to time may be appointed by the Governor. The Task Force shall include representatives of Missouri higher education institutions and Missouri companies which have expertise regarding hazardous wastes, as well as concerned citizens. The Chairman of the Task Force shall be designated by the Governor.

The purposes of the Task Force shall be as follows:

1. To examine and evaluate all known methods, processes and technologies for the destruction and containment of dioxin, particularly with respect to dioxin as it exists as a contaminant in soil and stream sediment at various locations in Missouri;

2. To examine and evaluate the public health dangers associated with dioxin, particularly with respect to dioxin as it exists as a contaminant in soil and stream sediment at various locations in Missouri;

3. To prepare and present, not later than June 1, 1983, an interim report which, inter alia, provides specific recommendations for solving those public health and environmental problems occurring in Times Beach, Missouri which are the result of dioxin contamination exacerbated by widespread flooding; and

4. To prepare and present, as soon as practicable but not later than October 1, 1983, a final report which includes the evaluations set forth in paragraphs 1 and 2 above, and which recommends a practical and effective plan of action for implementing comprehensive and permanent solutions to the public health and environmental problems caused by dioxin contamination in Missouri.

The Director of the Department of Natural Resources and the Director of the Division of Health shall make available such staff and support resources as are needed by the Task Force in the course of its deliberations. All meetings of the Task Force shall be open to the public, and a record shall be kept of all Task Force proceedings.

Members of the Task Force shall receive no compensation for their services, but shall be reimbursed from funds provided through the Department of Natural Resources for their reasonable and necessary expenses. The Task Force may contract for the services of such consultants and experts as it deems necessary and shall pay for such services from funds provided through the Department of Natural Resources or the Division of Health.

The Task Force shall meet at the call of the Chairman, or at the call of the Governor or his designate, and shall dissolve upon the issuance of its final report, unless extended by subsequent Executive Order.

IN TESTIMONY WHEREOF, I have hereunto set my hand and caused to be affixed the Great Seal of the State of Missouri, this 14th day of February, 1983.

Christopher S. Bond
GOVERNOR

ATTEST:

James C. Kirkpatrick
SECRETARY OF STATE

EXECUTIVE ORDER

83-13

WHEREAS, the Governor's Task Force on Dioxin was created by Executive Order 83-5 on February 14, 1983; and,

WHEREAS, said Executive Order provided that said Task Force was to prepare and present, as soon as practicable but not later than October 1, 1983, a final report, and that said Task Force was to dissolve upon issuance of said final report, unless extended by subsequent Executive Order; and

WHEREAS, need has arisen for said Task Force to obtain and evaluate additional information prior to preparation and presentation of said final report,

NOW THEREFORE I, CHRISTOPHER S. BOND, GOVERNOR OF THE STATE OF MISSOURI, by virtue of the authority vested in me by the Constitution and laws of Missouri, hereby extend the existence of the Governor's Task Force on Dioxin, as established by Executive Order 83-5 issued on February 14, 1983, until completion of its final report or until November 1, 1983, whichever sooner occurs, unless extended by subsequent Executive Order.

IN TESTIMONY WHEREOF, I have hereunto set my hand and caused to be affixed the Great Seal of the State of Missouri, this 31st day of August, 1983.

Christopher S. Bond

GOVERNOR

ATTEST:

James C. Kirkpatrick

SECRETARY OF STATE

GOVERNOR'S DIOXIN TASK FORCE

The Honorable James A. Finch, Jr.
Judge
Chairman, Governor's Dioxin Task Force

Mr. Dwight Douglas
Douglas, Douglas & Johnson Law Offices

Mr. Ray Forrester
Engineering Manager & Dioxin Project Supt.
Syntex Agribusiness, Inc.

Dr. Perry King
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Mallinkrodt, Inc.

Dr. Robert L. Powell
Assistant Professor of Chemical Engineering
Washington University

Dr. Carl J. Marienfeld
Professor of Family & Community Medicine
Environmental Health Surveillance Program
Sinclair Research Farm

Mrs. Sharon Rogers
Warren Countians Against Hazardous Waste

Dr. George Roush
Director, Dept. of Medicine & Environmental Health
Monsanto

Dr. James Shaddy
Associate Professor of Ecology
Northeast Missouri State University

Mrs. Betty Wilson
Environmental Quality Chairperson
League of Women Voters

TASK FORCE STAFF SUPPORT

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Ronald Kucera, Deputy Director

Robert Schreiber, Director - Division of Environmental Quality
Linda James, Assistant Director

David Bedan, Director - Waste Management Program
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